Appendix E2a.ii (1) – Restoration Plans and TMDLs (Restoration Credits)

MEMORANDUM

700 East Pratt Street, Suite 500
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Phone 410.728.2900
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www.rkk.com

Date: 11/29/2022

To: Christine Buckley, Harford County DPW, Watershed Protection and Restoration

From: Danielle Hankins, Project Manager

CC: Brittany Ayers, EIT, Associate Engineer; Lucia Noya, PE, Director

Re: 2022 Review and Verification of Impervious Acre Credits and Load Reduction Calculations

Introduction

As requested, RK&K has reviewed the documents provided for the following four (4) projects that completed construction in FY22:

- Fallston Library Stormwater Retrofit
- C Milton Wright Stream Restoration
- Stillmeadow Drive Stream Restoration
- Heavenly Pond Stream Restoration

The review was completed to verify the impervious acre credit and load reduction calculations associated with the completed restoration work as presented in the documentation provided. RK&K's calculations for Fallston Library Stormwater Retrofit, C. Milton Wright Stream Restoration and Stillmeadow Drive Stream & Outfall Restoration were completed following the guidelines presented in "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, November 2021). The calculations for Heavenly Pond Stream Restoration were completed following the guidelines presented in the August 2014 Wasteload Allocation Document.

Fallston Library Stormwater Retrofit

Summary: The restoration completed for Fallston Library included a retrofit of the existing dry extended detention pond into a bioretention facility. Impervious acre credit was calculated based on the impervious area within the drainage area, water quality volume, and the equivalent credit per acre for rainfall depths greater than 1 inch and less than or equal to 3 inches (Equation 9 of the MDE Wasteload Allocation Document).

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Bioretention	1.51	13.96	1.92	1.45

C. Milton Wright Stream Restoration

Summary: The restoration completed for C. Milton Wright included 3,644 linear feet of restoration. Impervious acre credit for the stream restoration was calculated using Protocols 1, 2, and 3 for stream restoration.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Stream Restoration	75.17	1,182.20	326.00	56.10

Stillmeadow Drive Stream Restoration & Stormwater SPSD

Summary: The restoration completed for Stillmeadow Drive included 1,550 linear feet of stream restoration. Impervious acre credit for the stream restoration was calculated using Protocols 1 and 2 for stream restoration and Protocol 4 for the stormwater SPSD.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Stream Restoration	28.49	255.10	32.00	229.40
Stormwater SPSD	4.41	30.04	6.68	9.71

Heavenly Pond Stream Restoration

Summary: The restoration completed for Heavenly Pond included 1,520 linear feet of stream restoration. This includes the linear footage through the pond. Impervious area credit was calculated based on the planning rate of 0.03 acres of credit per linear foot of restoration. This planning rate was applied because the project was completed before the Protocol guidance was released and the project site is located in the Piedmont region.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Stream Restoration	45.60	114.00	103.36	188.48

Should you have any questions please contact me at (410) 462-9160 at your earliest convenience.

Very truly yours,
RUMMEL, KLEPPER & KAHL, LLP

Danielle M Hankins

Danielle Hankins

Fallston Library Bioretention

Impervious Area Credit Summary:

Facility	DA Total (acres)	Impervious (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	Total IA Credit (acres)[1]
Bioretention	3.40	1.47	0.43	0.44	0.12	5,420	0.14	6,000	1.11	1.51

Nutrient Load Reduction Summary:

Nutrient	Removal Efficiency[2]	Delivery Factor[3]	Unit Load Source[5] per IA (lb/ac/yr)[4]	Unit Load Source[6] per Pervious Acre (lb/ac/yr)[4]	Average Unit Load (lb/ac/yr)	Nutrient Load Reduction (lb/yr)[7]
TN	0.612	0.76	36.43	8.19	20.40	13.96
TP	0.716	0.47	6.89	1.58	3.88	1.92
TSS	0.7677	0.24	20,055.00	3,552.00	10,687.12	2,894.55

[1] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Equation 9*

[2] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Table 3*

[3] *EOT Factor Map - https://mdewin64.mde.state.md.us/WSA/Trading/index.html*

[4] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Table 4*

[5] *Load Source = Impervious Road*

[6] *Load Source = Mixed Open*

[7] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Equation 4*

C. Milton Wright Stream Restoration

Impervious Area Credit and Nutrient Load Reduction Summary:

Protocol 1 Credit			Protocol 2 Credit	Protocol 3 Credit			Total Nutrient Credit			Site Length (Linear Feet)	Total Watershed Area (Acres)	Impervious Watershed Area (Acres)	Total IA Credit (acres)[1]
TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)	TN (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)				
657.00	302.00	53.00	301.00	224.20	24.00	3.10	1,182.20	326.00	56.10	3,644	80.40	11.50	75.17

[1] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Equation 5 and Table 22*

Stilllmeadow Stream Restoration

Impervious Area Credit and Nutrient Load Reduction Summary for Stream Restoration:

Protocol 1 Credit			Protocol 2 Credit	Total Nutrient Credit			Site Length (Linear Feet)	Total Watershed Area (Acres)	Impervious Watershed Area (Acres)	Total IA Credit (acres)[1]
TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)	TN (lbs/yr)	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)				
153.50	32.00	229.40	101.60	255.10	32.00	229.40	1,550	63.80	19.37	28.49

[1] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Equation 5 and Table 22*

Impervious Area Credit Credit Summary for SPSC:

Facility	DA Total (acres)	Impervious (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	IA Credit (acres)[2]	Green Infastructure Credit (acres)[3]	Total IA Credit (acres)
SPSC	7.35	2.51	0.34	0.36	0.22	9,534	0.48	20,981	2.20	3.26	1.14	4.41

[2] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Equation 9*

[3] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Equation 11*

Nutrient Load Reduction Summary for SPSC:

Nutrient	Removal Efficiency[4]	Delivery Factor[5]	Unit Load Source[7] per IA (lb/ac/yr)[6]	Unit Load Source[8] per Pervious Acre (lb/ac/yr)[6]	Average Unit Load (lb/ac/yr)	Nutrient Load Reduction (lb/yr)[9]
TN	0.671	1	36.43	8.19	17.83	30.04
TP	0.784	1	6.89	1.58	3.39	6.68
TSS	0.842	1	20,055.00	3,552.00	9,187.72	19,417.51

[4] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Table 3*

[5] *EOT Factor Map - https://mdewin64.mde.state.md.us/WSA/Trading/index.html*

[6] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Table 4*

[7] *Load Source = Impervious Road*

[8] *Load Source = Mixed Open*

[9] *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated (November 2021), Equation 4*

Total Impervious Area Credit and Nutrient Load Reduction Summary:

Total MS4 Credit (acres)	Total Nutrient Load Reduction (lb/yr)		
	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)
32.90	285.14	38.68	239.11

Heavenly Stream Restoration

Impervious Area Credit and Nutrient Load Reduction Summary:

Conversion Factors:

Nutrient	Lbs Reduced per Linear Foot
TN	0.075
TP	0.068
TSS	248

Facility	MS4 Credit per Linear Foot of Stream Restored (acres)[1]
Stream Restoration	0.03

	Linear Ft Restored	TN Annual Load Reduction (lbs)	TP Annual Load Reduction (lbs)	TSS Annual Load Reduction (lbs)	TSS Annual Load Reduction (tons)	Total IA Credit (acres)[2]
Stream Restoration	1,520	114.00	103.36	376,960.00	188.48	45.60

[1] *MDE's April 30, 2019 Memorandum: Stream Restoration Crediting Clarification for MS4 Permitting Purposes.*

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MEMORANDUM

Date: 06/08/2021 – Updated 11/18/2022

To: Christine Buckley, Harford County DPW, Watershed Protection and Restoration

From: Danielle Hankins, RK&K

CC: Brittany Ayers, RK&K; Lucy Noya, RK&K

Re: Review and Verification of Impervious Acre Credits and Load Reduction Calculations

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Dear Ms. Buckley,

As requested, RK&K has reviewed the documents you provided for the following one (1) projects completing construction in FY21:

- Emmord Branch Stream Restoration

The review was completed to verify the impervious acre credit and load reduction calculations associated with the completed restoration work as presented in the documentation provided. RK&K calculations were completed following the guidelines presented in "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, June 2020). Details regarding credit calculations are provided below. Details regarding each project follow.

Emmord Branch Stream Restoration

Summary: The restoration completed for Emmord Branch Stream Restoration include 975 linear feet of stream restoration. Impervious area credit was calculated using Stream Restoration Protocols 1 and 2.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Stream Restoration	58.48	495	216	206

Should you have any questions please contact me at (410) 462-9160 at your earliest convenience.

Very truly yours,
RUMMEL, KLEPPER & KAHL, LLP

Danielle M Hankins

Danielle Hankins

Emmord Branch Stream Restoration

Protocol 1 Credit			Protocol 2 Credit	Total Nutrient Credit			Site Length (Linear Feet)	Total Watershed Area (Acres)	Impervious Area (Acres)	**Equivalent Impervious Acre Treated[1] (acres)**
TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)	TN (lbs/yr)	**TN (lbs/yr)**	**TP (lbs/yr)**	**TSS (tons/yr)**				
470.00	216.00	206.00	25.00	**495.00**	**216.00**	**206.00**	975.00	25.40	3.79	**58.48**

[1]See MDE WLA 2020 Report, Equation 5

PROTOCOL 1

Unnamed Tributary to Emmord Branch

STEP 1: ESTIMATION OF EROSION RATES

Description	Bank Side (Facing DS)	Station Start	Station End	Bank Height (ft)	Radius of Curvature (ft)	Bankfull Width (ft)	BEHI Score	NBS Score*	Bulk Density of Soil (lb/cf)	Erosion Rate (ft/yr)			Length (ft)	Area (sf)	Sediment Load (ton/yr)		
										Colorado, 1989	USFWS Draft DC+	NRCS, NC+			Colorado, 1989	USFWS Draft DC	NRCS, NC
Main Branch	Left	1+30	1+60	8.5			Extreme	5	125	7.027	3.367	6.117	0+30	255	112.0	53.7	97.5
Main Branch	Right	1+30	1+60	7			High	5	125	0.872	1.641	0.282	0+30	210	11.4	21.5	3.7
Main Branch	Left	1+60	1+90	7			High	2	125	0.250	0.398	0.107	0+30	210	3.3	5.2	1.4
Main Branch	Right	1+60	1+90	7			High	2	125	0.250	0.398	0.107	0+30	210	3.3	5.2	1.4
Main Branch	Left	1+90	2+50	6			High	2	125	0.250	0.398	0.107	0+60	360	5.6	9.0	2.4
Main Branch	Right	1+90	2+50	5.5			High	2	125	0.250	0.398	0.107	0+60	330	5.2	8.2	2.2
Main Branch	Left	2+50	3+30	5			Moderate	2	125	0.153	0.113	0.016	0+80	400	3.8	2.8	0.4
Main Branch	Right	2+50	3+30	5			Moderate	2	125	0.153	0.113	0.016	0+80	400	3.8	2.8	0.4
Main Branch	Left	3+30	3+70	4.5			Moderate	2	125	0.153	0.113	0.016	0+40	180	1.7	1.3	0.2
Main Branch	Right	3+30	3+70	4.5			Low	2	125	0.036	0.019	---	0+40	180	0.4	0.2	---
Main Branch	Left	3+70	4+55	4.5			Low	4	125	0.155	0.315	---	0+85	382.5	3.7	7.5	---
Main Branch	Right	3+70	4+55	3.5			Moderate	4	125	0.420	0.812	0.106	0+85	297.5	7.8	15.1	2.0
Main Branch	Left	4+55	4+95	1			Moderate	2	125	0.153	0.113	0.016	0+40	40	0.4	0.3	0.0
Main Branch	Right	4+55	4+95	1			Moderate	2	125	0.153	0.113	0.016	0+40	40	0.4	0.3	0.0
Main Branch	Left	4+95	5+45	1			Moderate	2	125	0.153	0.113	0.016	0+50	50	0.5	0.4	0.0
Main Branch	Right	4+95	5+45	1			Moderate	2	125	0.153	0.113	0.016	0+50	50	0.5	0.4	0.0
Main Branch	Right	5+45	6+10	0.5			Low	2	125	0.036	0.019	---	0+65	32.5	0.1	0.0	---
Main Branch	Left	4+95	5+80	1			Moderate	2	125	0.153	0.113	0.016	0+85	85	0.8	0.6	0.1
Main Branch	Left	5+80	6+10	0.5			Low	2	125	0.036	0.019	---	0+30	15	0.0	0.0	---
Main Branch	Left	6+10	7+10	1.5			High	2	125	0.250	0.398	0.107	1+00	150	2.3	3.7	1.0
Main Branch	Right	6+10	7+10	1.5			High	2	125	0.250	0.398	0.107	1+00	150	2.3	3.7	1.0
Main Branch	left	7+10	7+80	3			Very High	5	125	0.872	1.641	1.139	0+70	210	11.4	21.5	15.0
Main Branch	Right	7+10	7+80	3			Very High	5	125	0.872	1.641	1.139	0+70	210	11.4	21.5	15.0
Main Branch	Right	7+80	8+30	4			Very High	5	125	0.872	1.641	1.139	0+50	200	10.9	20.5	14.2
Main Branch	Left	7+80	8+30	4			Very High	5	125	0.872	1.641	1.139	0+50	200	10.9	20.5	14.2
Main Branch	Left	8+30	8+95	6			Very High	5	125	0.872	1.641	1.139	0+65	390	21.3	40.0	27.8
Main Branch	Right	8+30	8+95	6			Very High	5	125	0.872	1.641	1.139	0+65	390	21.3	40.0	27.8
Trib 1	Left	0+00	0+60	8			Very High	5	125	0.872	1.641	1.139	0+60	480	26.2	49.2	34.2
Trib 1	Right	0+00	0+60	8			Very High	5	125	0.872	1.641	1.139	0+60	480	26.2	49.2	34.2
Trib 2	Left	0+00	0+66	7.5			Very High	5	125	0.872	1.641	1.139	0+66	495	27.0	50.8	35.2
Trib 2	Right	0+00	0+66	7.5			Very High	5	125	0.872	1.641	1.139	0+66	495	27.0	50.8	35.2
														Total	363	506	367

*Conservative estimate based on radius of curvature and bankfull estimate. Enter NBS directly when available.

+Low and Moderate set equal to High above NBS 4.

STEP 2: NUTRIENT LOADING

Nutrient	Site Specific (lb/ton)	CBP 2014 (lb/ton)
Phosphorus		1.05
Nitrogen		2.28

Estimated Reduction
50%

STEP 3: NUTRIENT REMOVAL

Bank Erosion	Nitrogen (lb/yr)	Phosphorus (lb/yr)	Sediment Load (lb/yr)
Colorado	**414**	**191**	**362916**
DC	**577**	**266**	**506041**
NC	**418**	**192**	**366592**
Average	**470**	**216**	**411850**

MEMORANDUM

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Date: 12/18/2020 – Updated 12/16/2021 – Updated 11/18/2022

To: Christine Buckley, Harford County DPW, Watershed Protection and Restoration

From: Danielle Hankins, RK&K

CC: Brittany Ayers, RK&K; Lucy Noya, RK&K

Re: Review and Verification of Impervious Acre Credits and Load Reduction Calculations

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Dear Ms. Buckley,

As requested, RK&K has reviewed the documents you provided for the following six (6) projects completing construction in FY20:

- Annie's Playground - Winter's Run Tributaries Stream Restoration
- Barrington and Rollins Court Stream Restorations and Stormwater Management
- Courthouse Micro-Bioretention
- Mariner Point Park Tree Planting Site
- Wakefield Plumtree Run Stream Restoration
- Willoughby Stream Restoration and Stormwater Management

The review was completed to verify the impervious acre credit and load reduction calculations associated with the completed restoration work as presented in the documentation provided. RK&K calculations were completed following the guidelines presented in "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, August 2014, December 2019 and June 2020).

Annie's Playground - Winter's Run Tributaries

Summary: The restoration completed for Winter's Run Tributaries include 3,258 linear feet of stream restoration. Impervious area credit was calculated based on the planning rate of 0.03 acres of credit per linear foot of restoration because the project site is located in the piedmont region (*MDE's April 30, 2019 Memorandum: Stream Restoration Crediting Clarification for MS4 Permitting Purposes*).

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Stream Restoration	97.74	244.35	221.54	403.99

Barrington Place and Rollins Court

Summary: The restoration completed for Barrington Place and Rollins Court included three stream restorations, two new stormwater management ponds, a new bioretention facility, and two SWM wetlands. The stream restorations included 2,754 linear feet of restoration. The Rollins Court Stream Restoration includes the SPSC. Impervious area credit for stream restorations were calculated based on the planning rate of 0.03 acres of credit per linear foot of restoration because the project site is located in the piedmont region.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Barrington Place Stream Restoration	21.00	52.50	47.60	86.80
SWM Pond #1	6.19	57.32	4.40	2.25
Bioretention	0.60	15.59	1.59	0.45
Barrington SWM Wetland	0.43	6.94	0.96	0.31
Rollins Court Stream Restoration	61.63	154.07	139.69	254.73
SWM Pond #2	1.00	31.88	2.56	0.64
Rollins SWM Wetland	1.60	25.99	2.87	0.84

Courthouse

Summary: The restoration completed for the Courthouse includes the creation of a new micro-bioretention facility.

Facility	Impervious Acre Credit (acres)	Green Infrastructure Credit (acres)	Total Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Micro-Bioretention	0.48	0.17	0.65	2.57	0.43	0.14

Mariner Point Park

Summary: The restoration completed for Mariner Point Park includes a tree planting site with 102 newly planted trees. Impervious acre credit was calculated based on the planning rate of 0.01 acres of credit per tree planted and the equivalent impervious acre factor of 0.28 for each acre converted.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (lbs.)
Tree Planting	0.29	3.24	0.52	83.64

Wakefield – Plumtree Run

Summary: The restoration completed for Plumtree Run include 286 linear feet of stream restoration. Impervious area credit was calculated based on the planning rate of 0.03 acres of credit per linear foot of restoration because the project site is located in the piedmont region.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Stream Restoration	8.58	21.45	19.45	35.46

Willoughby Beach Road Retrofits and Stream Restoration

Summary: The restoration completed for Willoughby Beach Road include 2,028 linear feet of stream restoration, two stormwater management pond retrofits, a SWM wetland, and two SPSCs at outfalls C and H. Impervious area credit for SPSCs was calculated based on the planning rate of 0.02 acres of credit per linear foot of restoration because the project site is in the coastal plain region. Impervious area credit for the stream restoration was calculated using Protocols 1 and 2 for stream restoration.

Facility	Impervious Acre Credit (acres)	TN Annual Load Reduction (lbs.)	TP Annual Load Reduction (lbs.)	TSS Annual Load Reduction (tons)
Stream Restoration	143.26	1363.00	517.00	493.00
SWM Pond #1	3.48	50.88	4.84	1.34
SWM Pond #2	2.22	38.34	3.68	1.01
SPSC Outfall H	5.32	19.95	18.09	32.98
Wetland	6.62	141.09	14.70	4.17
SPSC Outfall C	2.94	11.03	10.00	18.23

Should you have any questions please contact me at (410) 462-9160 at your earliest convenience.

Very truly yours,
RUMMEL, KLEPPER & KAHL, LLP

Danielle M Hankins

Danielle Hankins

Annie's Playground

Stream Restoration Conversion Factors	
TN (lbs reduced/LF)[1]	0.075
TP (lbs reduced/LF)[1]	0.068
TSS (lbs reduced/LF)[1]	248
IA Acre Credit/LF[2]	0.03

Facility	Linear Ft Restored	**TN Annual Load Reduction (lbs)**	**TP Annual Load Reduction (lbs)**	TSS Annual Load Reduction (lbs)	**TSS Annual Load Reduction (tons)**	**Impervious Acre Equivalent (acres)**
Winter's Run Tributaries Stream Restoration	3258	**244.35**	**221.54**	807984.00	**403.99**	**97.74**

[1]From 2019 MDE Accounting for Wasteload Allocations Report, Table 1

[2]From 4-30-2019 MDE Memorandum Stream Restoration Crediting Clarification for MS4 Permitting Purposes

Barrington Place and Rollins Court

Stream Restoration Conversion Factors	
TN (lbs reduced/LF)[1]	0.075
TP (lbs reduced/LF)[1]	0.068
TSS (lbs reduced/LF)[1]	248
IA Acre Credit/LF[2]	0.03

Facility	Linear Ft Restored	**TN Annual Load Reduction (lbs)**	**TP Annual Load Reduction (lbs)**	TSS Annual Load Reduction (lbs)	**TSS Annual Load Reduction (tons)**	**Impervious Acre Equivalent (acres)**
Stream Restoration	700	**52.50**	**47.60**	173600.00	**86.80**	**21.00**

[1]From 2019 MDE Accounting for Wasteload Allocations Report, Table 1

[2]From 4-30-2019 MDE Memorandum Stream Restoration Crediting Clarification for MS4 Permitting Purposes

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total IA Credit (acres)**	TN Annual Load (lbs)[3]	**TN Annual Load Reduction (lbs)[4]**	TP Annual Load (lbs)[3]	**TP Annual Load Reduction (lbs)[4]**	TSS Annual Load (tons)[3]	**TSS Annual Load Reduction (tons)[4]**
SWM Pond #1	13.88	7.00	0.50	0.50	0.58	25,388	0.51	22,433	0.88	**6.19**	181.40	**57.32**	8.87	**4.40**	3.56	**2.25**

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)**	TN Annual Load (lbs)[3]	**TN Annual Load Reduction (lbs)[4]**	TP Annual Load (lbs)[3]	**TP Annual Load Reduction (lbs)[4]**	TSS Annual Load (tons)[3]	**TSS Annual Load Reduction (tons)[4]**
Bioretention	5.77	1.65	0.29	0.31	0.15	6,438	0.05	2,351	0.37	**0.60**	69.74	**15.59**	4.56	**1.59**	1.01	**0.45**

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)**	TN Annual Load (lbs)[3]	**TN Annual Load Reduction (lbs)[4]**	TP Annual Load (lbs)[3]	**TP Annual Load Reduction (lbs)[4]**	TSS Annual Load (tons)[3]	**TSS Annual Load Reduction (tons)[4]**
SWM Wetland	3.50	2.28	0.65	0.64	0.19	8,084	0.04	1,530	0.19	**0.43**	48.06	**6.94**	4.38	**0.96**	1.09	**0.31**

[3]See MDE WLA 2014 Report, Table A.1

[4]See MDE WLA 2014 Report, Table 2.E

Barrington Place and Rollins Court

Stream Restoration Conversion Factors	
TN (lbs reduced/LF)[1]	0.075
TP (lbs reduced/LF)[1]	0.068
TSS (lbs reduced/LF)[1]	248
IA Acre Credit/LF[2]	0.03

Facility	Linear Ft Restored	**TN Annual Load Reduction (lbs)**	**TP Annual Load Reduction (lbs)**	TSS Annual Load Reduction (lbs)	**TSS Annual Load Reduction (tons)**	**Impervious Acre Equivalent (acres)**
Stream Restoration	2054	**154.07**	**139.69**	509468.88	**254.73**	**61.63**

[1]From 2019 MDE Accounting for Wasteload Allocations Report, Table 1

[2]From 4-30-2019 MDE Memorandum Stream Restoration Crediting Clarification for MS4 Permitting Purposes

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)**	TN Annual Load (lbs)[3]	**TN Annual Load Reduction (lbs)[4]**	TP Annual Load (lbs)[3]	**TP Annual Load Reduction (lbs)[4]**	TSS Annual Load (tons)[3]	**TSS Annual Load Reduction (tons)[4]**
SWM Pond #2	8.33	0.97	0.12	0.15	0.11	4,681	0.12	5,169	1.10	**1.00**	94.33	**31.88**	4.80	**2.56**	0.94	**0.64**

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)**	TN Annual Load (lbs)[3]	**TN Annual Load Reduction (lbs)[4]**	TP Annual Load (lbs)[3]	**TP Annual Load Reduction (lbs)[4]**	TSS Annual Load (tons)[3]	**TSS Annual Load Reduction (tons)[4]**
SWM Wetland	6.19	2.15	0.35	0.36	0.19	8,148	0.14	6,077	0.75	**1.60**	76.53	**25.99**	5.37	**2.87**	1.23	**0.84**

[3]See MDE WLA 2014 Report, Table A.1

[4]See MDE WLA 2014 Report, Table 2.E

Courthouse

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)***	TN Annual Load (lbs)[1]	**TN Annual Load Reduction (lbs)[2]**	TP Annual Load (lbs)[1]	**TP Annual Load Reduction (lbs)[2]**	TSS Annual Load (tons)[3]	**TSS Annual Load Reduction (tons)[2]**
Micro Bioretention	0.48	0.44	0.92	0.88	0.04	1,525	0.05	2,081	1.36	**0.65**	7.16	**2.57**	0.76	**0.43**	0.20	**0.14**

[1]See MDE WLA 2014 Report, Table A.1

[2]See MDE WLA 2014 Report, Table 2.E

*Including GSI Credit from MDE WLA 2020 Report, Equation 11

Mariner Point Park

Tree Planting Conversion Factors	
TN (lbs reduced/LF)[1]	3.18
TP (lbs reduced/LF)[1]	0.51
TSS (lbs reduced/LF)[1]	82
Acres Planted/Tree Planted	0.01
IA Acre Credit/Acre Planted[1]	0.28

Facility	Total Trees	Acres of Tree Planting	**Total Credit (acres)**	**TN Annual Load Reduction (lbs)**	**TP Annual Load Reduction (lbs)**	TSS Annual Load Reduction (lbs)	**TSS Annual Load Reduction (tons)**
Urban Tree Canopy Planting	102	1.02	**0.29**	**3.24**	**0.52**	83.64	**0.04**

[1]MDE WLA 2020 Report, Table 1

Wakefield - Plumtree Run

Stream Restoration Conversion Factors	
TN (lbs reduced/LF)[1]	0.075
TP (lbs reduced/LF)[1]	0.068
TSS (lbs reduced/LF)[1]	248
IA Acre Credit/LF[2]	0.03

Facility	Linear Ft Restored	**TN Annual Load Reduction (lbs)**	**TP Annual Load Reduction (lbs)**	TSS Annual Load Reduction (lbs)	**TSS Annual Load Reduction (tons)**	**Impervious Acre Equivalent (acres)**
Unnamed Tributary to Plumtree Run Stream Restoration	286	**21.45**	**19.45**	70928.00	**35.46**	**8.58**

Willoughby Beach Road Retrofits and Stream Restoration

TMDL Credit[2]			Site Length (Linear Feet)	Total Watershed Area (Acres)	Impervious Area (Acres)	**Equivalent Impervious Acre Treated[1] (acres)**
TN (lbs/yr)	**TP (lbs/yr)**	**TSS (tons/yr)**				
1363.00	**517.00**	**493.00**	2028.00	191.00	99.32	**143.26**

[1] See June 2020 Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated

[2] See Procol 1 and 2 Calculations with Project Documents (KCI)

Stream Restoration Conversion Factors	
TN (lbs reduced/LF)[3]	0.075
TP (lbs reduced/LF)[3]	0.068
TSS (lbs reduced/LF)[3]	248
IA Acre Credit/LF[4]	0.02

Facility	Linear Ft Restored	**TN Annual Load Reduction (lbs)**	**TP Annual Load Reduction (lbs)**	TSS Annual Load Reduction (lbs)	**TSS Annual Load Reduction (tons)**	**Impervious Acre Equivalent (acres)**
SPSC Outfall H	266	**19.95**	**18.09**	65968.00	**32.98**	**5.32**

Facility	Linear Ft Restored	**TN Annual Load Reduction (lbs)**	**TP Annual Load Reduction (lbs)**	TSS Annual Load Reduction (lbs)	**TSS Annual Load Reduction (tons)**	**Impervious Acre Equivalent**
SPSC Outfall C	147	**11.03**	**10.00**	36456.00	**18.23**	**2.94**

[3]From 2019 MDE Accounting for Wasteload Allocations Report, Table 1

[4]From 4-30-2019 MDE Memorandum Stream Restoration Crediting Clarification for MS4 Permitting Purposes

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)**	TN Annual Load (lbs)[5]	**TN Annual Load Reduction (lbs)[6]**	TP Annual Load (lbs)[5]	**TP Annual Load Reduction (lbs)[6]**	TSS Annual Load (tons)[5]	**TSS Annual Load Reduction (tons)[6]**
SWM Pond #1	10.25	2.32	0.23	0.25	0.22	9,440	0.68	29,655	3.14	**3.48**	121.14	**50.88**	7.33	**4.84**	1.58	**1.34**

Facility	Drainage Area (acres)	Impervious Area (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)**	TN Annual Load (lbs)[5]	**TN Annual Load Reduction (lbs)[6]**	TP Annual Load (lbs)[5]	**TP Annual Load Reduction (lbs)[6]**	TSS Annual Load (tons)[5]	**TSS Annual Load Reduction (tons)[6]**
SWM Pond #2	8.55	2.02	0.24	0.26	0.19	8,151	0.26	11,379	1.40	**2.22**	101.43	**38.34**	6.22	**3.68**	1.35	**1.01**

Facility	DA Total (acres)	DA Impervious (acres)	% Impervious	Rv	WQv Required (acre-feet)	WQv Required (cubic feet)	WQv Provided (acre-feet)	WQv Provided (cubic feet)	Pe Equivalent (inches)	**Total Credit (acres)**	TN Annual Load (lbs)[5]	**TN Annual Load Reduction (lbs)[6]**	TP Annual Load (lbs)[5]	**TP Annual Load Reduction (lbs)[6]**	TSS Annual Load (tons)[5]	**TSS Annual Load Reduction (tons)[6]**
Wetland	44.75	13.19	0.29	0.32	1.18	51,214	0.59	25,709	0.50	**6.62**	542.66	**141.09**	35.86	**14.70**	8.01	**4.17**

[5]See MDE WLA 2014 Report, Table A.1

[6]See MDE WLA 2014 Report, Table 2.E

Watershed Projection and Restoration

Active Projects

12/13/2022

Total
657

Credits - IA (acres)	Construction Complete (FY)	Project Name	Project Type	Ownership
2.7	2023	Cedar Lane Park adjacent to SWM facility	Forest Tree Planting	Public
1.2	2023	Harford Community College	Forest Tree Planting	Public
2.6	2023	North Harford Schools	Forest Tree Planting	Public (Schools)
0.2	2023	North Harford Schools	Tree Canopy Planting	Public (Schools)
1.7	2024	Gavigans	Stormwater (Upgrade)	Private
1.5	2024	Hickory Vet Retrofit	Stormwater (Upgrade)	Private
7.3	2024	Spenceola	Stormwater (Upgrade)	Private
3.3	2024	Jarrettsville Elementary School	Stormwater Retrofit	Public
44.0	2024	Trib to First Mine Branch	Stream Restoration	Private
43.4	2024	Church Creek Elementary	Stream Restoration	Public
3.9	2024	Church Creek Elementary	Stormwater (Upgrade)	Public
0.4	2024	Church Creek Elementary	Stormwater (Upgrade)	Public
0.7	2024	Grove Landscaping	Conservation Landscaping	Public
3.3	2024	Grove Landscaping	Forest Tree Planting	Public
0.3	2024	Grove Landscaping	Tree Canopy Planting	Public

Credits - IA (acres)	Construction Complete (FY)	Project Name	Project Type	Ownership
0.8	2024	Harford Community College	Conservation Landscaping	Public
0.9	2024	North Harford Schools	Conservation Landscaping	Public (Schools)
260.8	2024	Fallston MS, Fallston HS	Stream Restoration	Public (Schools)
4.9	2024	Fallston MS, Fallston HS	Stormwater (New)	Public (Schools)
5.1	2024	Fallston MS, Fallston HS	Stormwater (New)	Public (Schools)
95.1	2025	Sunnyview	Stream Restoration	Private
69.3	2025	Declaration	Stream Restoration	Private
33.6	2025	Woodland	Stream Restoration	Private
70.0	2025	Watervale	Stream Restoration	Private

Harford County, MD Department of Public Works
Watershed Protection and Restoration
Completed Capital Improvement Projects (MS4 Permit 11-DP-3310)

Robert Cassilly
County Executive

	Project	Construction Complete	Impervious Credits (ac)	Total Cost [1]	Grants	Cost per Credit
WP000014	Heavenly Pond Wetland & Stream Creation	May 2022	45.60	$1,381,397	$980,000	$30,294
WP000091	C Milton Wright Stormwater Retrofit and Stream Restoration	Feb 2022	75.17	$1,872,295	$0	$24,907
WP000037	Stillmeadow Stream Restoration	Dec 2021	32.89	$1,052,140	$0	$31,988
WP000102	Fallston Library SWM Retrofit	Nov 2021	1.51	$308,586	$0	$204,362
WP000085	Emmord Stream Restoration	Oct 2020	58.48	$735,002	$0	$12,568
WP000105	Mariner Point Tree Planting	Jun 2020	0.29	$78,899	$0	$272,067
WP000104	Courthouse Bioretention	May 2020	0.65	$168,358	$0	$259,013
WP000033	Willoughby Beach SWM Retrofit & Stream Restoration	May 2020	163.82	$1,610,587	$1,100,000	$9,831
WP000039	Plumtree Run at Barrington Stream Restoration	May 2020	92.43	$3,287,052	$0	$35,563
WP000087	Tributary to Plumtree Run at Wakefield Manor Stream Restoration	Dec 2019	8.58	$97,159	$0	$11,324
WP000086	Annie's Playground Stream Restoration	Oct 2019	98.88	$700,865	$350,000	$7,088
WP000088	Stormwater Retrofit at Homestead Elementary	Jun 2019	1.57	$131,374	$0	$83,678
WP000029	Bynum at St Andrews Way Stream Restoration	May 2019	92.52	$2,095,854	$1,600,000	$22,653
WP000035	Ring Factory ES SWM Retrofit & Stream Restoration	Jun 2018	41.33	$1,490,585	$660,132	$36,065

1 Projects with Total Cost blank were not initiated as a restoration project and were completed for other reasons. Therefore, funding has been intentionally left blank.
2 Average of the costs per credit excluding projects with missing costs.

Printed 12/13/2022

Harford County, MD Department of Public Works
Watershed Protection and Restoration
Completed Capital Improvement Projects (MS4 Permit 11-DP-3310)

Robert Cassilly
County Executive

	Project	Construction Complete	Impervious Credits (ac)	Total Cost [1]	Grants	Cost per Credit
WP000074	Bear Cabin Branch Wetland and Stream Restoration	May 2018	110.25	$1,090,000	$775,000	$9,887
WP000070	Abingdon Library Water Quality Improvements	Nov 2017	3.70	$215,891	$0	$58,349
WP000046	Leight Center Parking Lot Green Infrastructure	Nov 2017	0.41	$277,450	$125,000	$676,706
WP000027	Lower Wheel Creek SWM Retrofit & Stream Restoration	Nov 2017	139.52	$2,151,558	$1,467,771	$15,421
WP000025	Wheel Creek at Country Walk 1B SWM Retrofit	Jun 2017	3.66	$292,152	$118,614	$79,823
WP000036	Foster Branch at Dembytown Stream Restoration	Apr 2017	42.10	$902,662	$500,000	$21,441
WP000024	Wheel Creek at Country Walk 1A SWM Retrofit	Jun 2016	8.66	$576,532	$324,119	$66,574
WP000026	Wheel Creek at Festival at Bel Air SWM Retrofit	Feb 2016	12.00	$385,601	$195,436	$32,133
WP000095	Willoughby Beach Road Tree Planting	Oct 2015	0.50	$11,844	$11,844	$23,688
WP000096	Trappe Church Road Tree Planting	Oct 2015	0.26	$6,802	$6,802	$26,163
WP000073	Hickory Elementary Retrofit	Jul 2015	0.75	$82,199	$0	$109,598
WP000031	Norrisville Elementary Bioretention	Jun 2015	0.63	$112,600	$50,000	$178,730
WP000052	Edwards Lane Tree Planting II	Apr 2015	1.71	$30,772	$30,772	$17,995
WP000020	Woodbridge Stream Restoration	Apr 2015	24.60	$553,083	$258,832	$22,483

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2 Average of the costs per credit excluding projects with missing costs.

Harford County, MD Department of Public Works
Watershed Protection and Restoration
Completed Capital Improvement Projects (MS4 Permit 11-DP-3310)

Robert Cassilly
County Executive

	Project	Construction Complete	Impervious Credits (ac)	Total Cost [1]	Grants	Cost per Credit
WP000094	Magnolia Middle School Tree Planting II	Apr 2015	0.47	$12,267	$12,267	$26,101
WP000093	Red Pump Elementary School Tree Planting II	Apr 2015	0.58	$17,742	$17,742	$30,589
WP000063	Rider Lane Tree Planting	Apr 2015	0.63	$18,302	$18,302	$29,051
WP000051	Amoss Mill Road Tree Planting II	Apr 2015	0.21	$6,291	$6,291	$29,958
WP000055	Patterson Mill High School Tree Planting II	Apr 2015	1.20	$25,519	$25,519	$21,266
WP000060	Edwards Lane Tree Planting	Oct 2014	0.98	$25,952	$25,952	$26,482
WP000062	Harford Christian School Tree Planting	Oct 2014	0.50	$15,972	$15,972	$31,944
WP000061	Amoss Mill Road Tree Planting	Oct 2014	0.18	$8,448	$8,448	$46,933
WP000032	Foster Branch at Trimble Road Stream Restoration	May 2014	24.26	$570,051	$275,000	$23,498
WP000058	North Harford High School Tree Planting	Apr 2014	0.15	$3,593	$3,593	$23,953
WP000059	Perryman Wellfield Tree Planting	Apr 2014	1.81	$43,183	$43,183	$23,858
WP000054	Mt Soma Property Tree Planting	Apr 2014	1.04	$28,684	$28,684	$27,581
WP000056	Magnolia Middle School Tree Planting	Apr 2014	0.23	$5,295	$5,295	$23,022
WP000048	Heaven Waters Boulton Street Tree Planting	Oct 2013	0.22	$7,546	$7,546	$34,300

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2 Average of the costs per credit excluding projects with missing costs.

Harford County, MD Department of Public Works
Watershed Protection and Restoration
Completed Capital Improvement Projects (MS4 Permit 11-DP-3310)

Robert Cassilly
County Executive

	Project	Construction Complete	Impervious Credits (ac)	Total Cost [1]	Grants	Cost per Credit
WP000019	Woodbridge SWM Retrofit	Oct 2013	3.80	$256,467	$0	$67,491
WP000049	Churchville Recreation Complex Tree Planting	Oct 2013	0.32	$7,434	$7,434	$23,231
WP000050	Walters Mill Tree Planting	Oct 2013	1.03	$31,099	$31,099	$30,193
WP000053	Harford Center Tree Planting	Oct 2013	0.27	$9,983	$9,983	$36,974
WP000022	Wheel Creek at Gardens of Bel Air SWM Retrofit	Jul 2013	4.79	$322,120	$178,804	$67,248
WP000030	Wheel Creek at Calvert Walks Stream Restoration	May 2013	21.75	$324,682	$204,951	$14,928
WP000057	Patterson Mill High School Tree Planting	Apr 2013	0.80	$23,688	$23,688	$29,610
WP000068	Cedarwood Pump Station Demolition	Aug 2012	0.05			
WP000018	Friends Pond SWM Retrofit	Oct 2011	11.70	$109,761	$0	$9,381
WP000012	Bynum Ridge Stream Stablization	Jul 2011	13.95	$225,212	$0	$16,144
WP000017	Hickory Elementary School Bioretention	Jun 2011	0.60	$179,013	$0	$298,354
WP000016	Forest Hill Elementary School Bioretention	Jun 2011	0.91	$102,804	$0	$112,972
WP000013	Plumtree Run at Tollgate Stream Restoration	May 2011	50.40	$428,877	$215,000	$8,509
WP000042	Washington Court Demolition	Jan 2011	2.11			

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2 Average of the costs per credit excluding projects with missing costs.

Harford County, MD Department of Public Works
Watershed Protection and Restoration
Completed Capital Improvement Projects (MS4 Permit 11-DP-3310)

Robert Cassilly
County Executive

	Project	Construction Complete	Impervious Credits (ac)	Total Cost [1]	Grants	Cost per Credit
WP000015	Abingdon Library Bioretention	Oct 2010	0.60	$106,644	$53,322	$177,740
		Totals	1208.01	$24,615,930	$9,772,399	$66,758 [2]

Harford Streams

Green Choices ... Healthy Streams

Harford Streams is a program developed and administered through Harford County Department of Public Works
HarfordStreams@HarfordCountyMD.gov www.Facebook.com/HarfordStreams
(410) 638-3217

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2 Average of the costs per credit excluding projects with missing costs.

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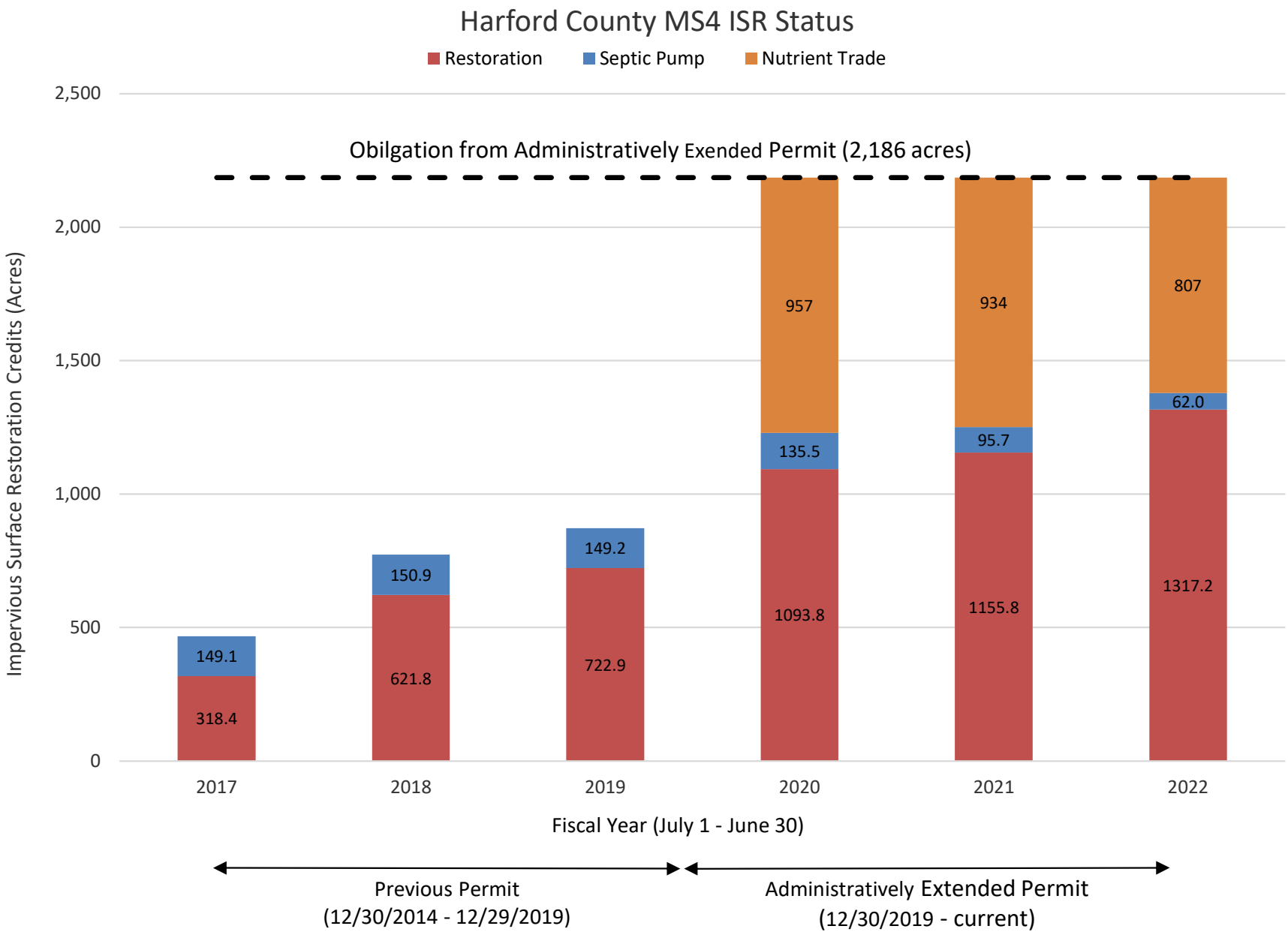
Harford County MS4 ISR Status
Restoration
Septic Pump
Nutrient Trade
2,500
2,000
1,500
1,000
500
0
Impervious Surface Restoration Credits (Acres)
Obilgation from Administratively Exended Permit (2,186 acres)
149.1
318.4
150.9
621.8
149.2
722.9
135.5
957
1093.8
95.7
934
1155.8
62.0
807
1317.2
2017
2018
2019
2020
2021
2022
Fiscal Year (July 1 - June 30)
Previous Permit
(12/30/2014 - 12/29/2019)
Administratively Extended Permit
(12/30/2019 - current)

12/30/2022